Remarks

Claims 1, 2, 3 – 9, and 13-15 remain in the application.

The examiner has not considered the prior art cited in the information disclosure statement of 1/24/2008 because it lacks a copy of the cited non-US patent application. The examiner also has not considered the art cited in the specification without a parallel cite in a separate paper. A new information disclosure statement is submitted herewith.

The examiner objects to the drawings. A substitute set of drawings are submitted herewith.

The examiner objects to informalities in various claims. The claims have been amended as suggested by the examiner.

The examiner provisionally rejects claims 1 and 2 for obviousness-type double patenting over claims 1, 4, and 28 of co-pending application 10/505,051. The examiner is requested to withdraw the provisional ODP rejection. The present application relates to a light-emitting diode while 10/505,051 relates to a field-effect transistor. Although both are light-emitting elements, the present diode differs from the field-effect transistor of the copending application in structure and operation and one is not obvious over the other.

The examiner rejects claims 1-10 under 35 U.S.C. 112, second paragraph for indefiniteness.

In claim 1, the examiner objects to "which". It is unclear where the unclarity arises. The claim has nonetheless been rewritten to provide clearer antecedent basis.

In claim 1, the examiner states that the term "non-barrier junction" is indefinite. Although this term is not common, it is adequately defined by Applicants in their filed application at [0107] of US 2006/0261350:

> "In the case of the n-electrode, if the work function of the n-electrode is lower than the conduction band edge energy of the ambipolar inorganic semiconductor, a combination is formed which does not create the barrier between them. In the case of the p-electrode

if the work function of the p-electrode is higher than the conduction [*sic* valence] band edge energy of the ambipolar inorganic semiconductor, a combination is formed with does not create the barrier between them."

The error between conduction and valence band edges in the above passage is an error clear to the ordinary artisan in the field of semiconductor electronics and is obviously corrected as indicated. The following paragraph [0108] describes the formation of a "non-barrier junction". Accordingly, Applicants acting as their own lexicographer have adequately defined the objected term.

The claimed non-barrier contact differs from Mensz's ohmic contact, as will be discussed below for the substantive rejection.

In claim 8, the examiner states that "each other" is unclear. This claim has been rewritten to remove that language.

In claim 9, the examiner questions whether "an ambipolar semiconductor material" is the same or different from the same term in claim 1. It is the same and the claim has been amended to recite the definite article. The same amendment has been made in claim 8.

The examiner has rejected claims 1-3 and 7-10 under 35 U.S.C. 102(b) as being anticipated by Mensz (U.S. patent 5,422,902). Claim 3 has been incorporated into claim 1. The rejection of so amended claim 1 is traversed. Mensz discloses a quantum well laser having, as disclosed at col. 6, lines 36-39, an active regions 26 consisting of three undoped CdZnSe quantum wells separated by two undoped ZnSe spacer regions. Mensz's discussion at col. 6, line 66 to col. 7, line for the thicknesses of the active region is somewhat muddled but he seems to say that the quantum well region 26 encompassing the multiple quantum wells has a thickness of 6nm, which is significantly below the claimed minimum thickness of 10nm. As is well known in the art, quantum wells need to be thin to affect the quantum levels therein. The examiner identifies the claimed light-emitting thickness with the 1.5 microns, which however Mensz associates with the cladding layer 30 and contact layer 16. These are not the light emitting layers of Mensz; these are his cladding and contact layers, which alternatively guide the light emitted from the active region and provide electrical power to the active region. Mensz's three quantum

wells emit light.

The examiner identifies the claimed non-barrier contact with Mensz's ohmic contact. This identification is incorrect. First of all, Mensz's ohmic contact layer 16 does not contact an ambipolar light emitting layer; it contacts his p-type Zn(S,Se) waveguide layer 30, which is neither ambipolar nor light emitting. Further the non-barrier interface of the claims differs from Mensz's ohmic contact layer 16 of BeTe/ZnSe and ZnSe providing a ohmic contact to his p-Zn(SSe) cladding layer 30 (col. 5, line 5). As is clear from Mensz's FIG. 2 with its Fermi level E_F closely adjacent its valence band E_V, Mensz's ohmic contact layer 16 is p-type, similarly to his adjacent p-Zn(SSe) cladding layer such that Mensz's interface is a p-p junction. An ohmic contact could similarly be formed of an n-n junction although Mensz does not disclose an n-n ohmic contact. In contrast, the claimed contacts between the light-emitting layer and the n-electrode or p-electrode are between n-type and ambipolar and between p-type and ambipolar. The claimed structure cannot be interpreted as producing both an n-n ohmic contact, not disclosed by Mensz, and the p-p ohmic contact of Mensz.

Further, Mensz's light emitting quantum wells barriers are not disclosed to be ambipolar. Applicants describe at [0048] and [0049] the requirements of an ambipolar material as being able to transport both electrons and holes. Generally, in an ambipolar material, the product of the electron concentration and electron mobility is approximately equal to the product of the hole concentration and hole mobility. The ambipolar nature of a material is determined by a number of factors including source of the material, crystallinity, defects, intended dopants and their concentration. By simultaneously co-doping donors and acceptors, the polarity of a semiconductor is compensated or neutralized such that carries density with the semiconductor does not depend on doping density but instead thermally excited carriers dominate. An ambipolar semiconductor, regardless of whether it is undoped of counter-doped, exhibits low carrier density in thermal equilibrium and its electrical conductivity depents on carriers injected from the contacting electrode. An amount of injected carriers depends in part on the work functions of the electrodes relative to the semiconductor and is determined by the potential barriers formed at the interface and the applied electric field.

An undoped layer of, for example, Mensz's ZnSe or CdZnSe is not inherently ambipolar but depends on many factors not mentioned by Mensz. Applicants provide a long discussion of the nature of ambipolar semiconductors at [0057], [0058], and [0061] and several methods for determining whether the semiconductor material is ambipolar at [0060]. Mensz fails to similarly quantify his undoped layers.

Mensz does not describe his quantum well or barrier materials as being ambipolar. His undoped semiconductor material could well favor either electron or hole transport and not be ambipolar. Mensz's ZnSe and CdZnSe are not inherently ambipolar.

The examiner has rejected claims 4-6 under 35 U.S.C. 103(a) as being obvious over Mensz. These claims depend from claims believed to be in allowable form and should therefore also be allowable.

Further, these claims require not only that the electrode layer be formed of n- or p-type materials, as the examiner identifies to Mensz's cladding layers 22 and 30, but that the dopants therein diffuse into the ambipolar inorganic semiconducting material. Mensz's spacer layers within his quantum well active region impede the diffusion of dopants from the electrodes into his undoped region, which the examiner incorrectly identifies as ambipolar. The lack of a barrier recited in claim 1, on the other hand, permits the ready diffusion of dopants across the contact between the electrode and the ambipolar semiconductor layer.

A new set of claims has been added to more clearly specify the relatively thick (10nm to 100nm) uniform light emitting layer of the invention and to distinguish over the quantum well structure of Mensz.

In view of the above amendments and remarks, early consideration and allowance of all claims are respectfully requested. If the Examiner believes that a telephone interview would be helpful, he is invited to contact the undersigned attorney at the listed telephone number, which is on California time.

Respectfully submitted,

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